



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/583,121	03/19/2007	Igor Lvovich Skryabin	ADAPLU P05AUS	3214
20210 7590 12/21/2010 DAVIS & BUJOLD, P.L.L.C. 112 PLEASANT STREET CONCORD, NH 03301				
EXAMINER				
RIPA, BRYAND				
ART UNIT		PAPER NUMBER		
1723				
MAIL DATE		DELIVERY MODE		
12/21/2010		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/583,121

Applicant(s)

SKRYABIN ET AL.

Examiner

BRYAN D. RIPA

Art Unit

1723

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 November 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14, 16-19 and 23-30 is/are pending in the application.
- 4a) Of the above claim(s) 18 and 19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 14, 16, 17 and 23-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-946)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

In response to the amendment received on November 12, 2010:

- claims 14, 16-19 and 23-30 are presently pending
- the objection to the drawings is withdrawn in light of the amended drawings filed on November 12, 2010
- all prior art rejections are withdrawn in light of the amendments to the claims
- new grounds of rejection are presented below
- no prior art rejections are made with respect to claims 27, 28 and 30

Please note, all references to "the specification" are references to Applicant's specification as published as U.S. Pub. No. 2008/0105362.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

1. Claims 27, 28 and 30 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Specifically, newly added claims 27 and 30 each recite an additionally limitation further limiting the chemically different ions, of independent claims 14 and 29 respectively, to result from the dissolution of yttrium salts in the electrolyte (see claims 27 and 30). However, the Examiner has been unable to locate any disclosure in the specification that would appear to provide support for such a limitation.

The specification discloses generally the concept of deposition of a material to form a barrier layer which is described as a metal oxide at paragraph 16. However, there is no recitation of the use of yttrium salts in the electrolyte. The specification further provides one example where yttrium chloride is disclosed as being used in the electrolyte (see ¶34). However, besides this single recitation of the use of yttrium chloride, the specification is silent as to the use of other additional yttrium salts.

As a result, the specification cannot be said to reasonably convey to one of ordinary skill in the art at the time the application was filed that the inventor had possession of the claimed subject matter.

Likewise, regarding the limitations of newly added claim 28, claim 28 recites the limitation requiring the chemically different ions to be either trivalent metals or rare earth metals (see claim 28). However, as with the limitations discussed above, the Examiner has been unable to locate any disclosure within the specification that would appear to readily provide support for such a limitation.

While it is noted that the specification does disclose the use of yttrium as the chemically different ion (see ¶34), which is both a trivalent metal and a rare earth metal,

the specification fails to mention the use of any other metal such as a trivalent metals or rare earth metals as presently claimed.

As a result, the specification cannot be said to reasonably convey to one of ordinary skill in the art at the time the application was filed that the inventor had possession of the claimed subject matter.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 14, 23 and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by "Electrodeposited Nanocomposite n-p Heterojunctions for Solid-State Dye-Sensitized Photovoltaics" by Regan et al., *Adv. Mat.* 12 (17), pages 1263-1267 (2000) (hereinafter referred to as "REGAN").

Regarding claim 14, REGAN teaches a method for manufacturing a nano-particulate electrode for Dye Solar Cells (see generally first paragraph on page 1263) including the steps of:

- providing an electrically conductive substrate (see page 1266 under the section titled "Experimental" teaching the use of a conductive SnO₂ substrate);

- forming a nano-particulate layer on the substrate (see same section on page 1266 teaching the formation of a ZnO layer; see also page 1263 describing the ZnO as being a nano-porous nano-crystalline metal oxide);
- electrolytically treating the nano-particulate layer in an electrolyte (see "Experimental" section on page 1267 teaching the placing of the dyed electrodes in an electrolyte for the deposition of CuSCN), wherein the electrolyte contains ions chemically different to the nano-particulate layer and the electrolytic treatment step comprises transferring the chemically different ions into the surface of the nano-particulate layer (see "Experimental" section on page 1267 teaching the deposition of CuSCN comprising both Cu and SCN ions which are chemically different from the ZnO layer); and
- applying a dye to the nano-particulate layer (see "Experimental" section on page 1266 teaching the application of a monolayer of dye to the ZnO layer).

Please note, since the nano-particulate layer is a porous layer, it is noted that the "surface" of the nano-particulate layer into which the chemically different ion are being transferred, is being interpreted by the Examiner as meaning the exterior boundary of the porous layer and not the actual surface of the metal oxide crystals.

Regarding claim 23, REGAN teaches the method for manufacturing a nano-particulate electrode for Dye Solar Cells further comprising the step of the electrolytically treating including at least one step of transferring a predetermined amount of electrical charge between the electrolyte and the nano-particulate layer (see

"Experimental" section on page 1267 teaching the total amount of current passed, i.e. the charge, given 0.4 C/cm^2).

Regarding claim 29, REGAN teaches a method for manufacturing a nano-particulate electrode for Dye Solar Cells (see generally first paragraph on page 1263) including the steps of:

- providing an electrically conductive substrate (see page 1266 under the section titled "Experimental" teaching the use of a conductive SnO_2 substrate);
- forming a nano-particulate layer on the substrate (see same section on page 1266 teaching the formation of a ZnO layer; see also page 1263 describing the ZnO as being a nano-porous nano-crystalline metal oxide);
- electrolytically treating the nano-particulate layer in an electrolyte (see "Experimental" section on page 1267 teaching the placing of the dyed electrodes in an electrolyte for the deposition of CuSCN), wherein the electrolyte contains ions chemically different to the nano-particulate layer and the electrolytic treatment step comprises transferring the chemically different ions into the surface of the nano-particulate layer to a depth of approximately 40 Angstroms (see "Experimental" section on page 1267 teaching the deposition of CuSCN comprising both Cu and SCN ions which are chemically different from the ZnO layer); and
- applying a dye to the nano-particulate layer (see "Experimental" section on page 1266 teaching the application of a monolayer of dye to the ZnO layer).

It is further noted, that although REGAN does not explicitly teach the plating of the CuSCN to a depth of approximately 40 Angstroms as claimed, REGAN does teach the electrodeposition onto a nano-porous semiconductor oxide layer like that of the Applicant. Consequently, it would be expected that the use of an electrodeposition process on a similar substrate would result in the deposition occurring at the same depth in the nano-porous layer. As such, the Examiner is treating the limitation requiring the transferring of the chemically different ions into a depth of approximately 40 Angstroms as being inherently taught by the method of REGAN.

3. Claims 14, 23 and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by "Improved Performance of a Dye-Sensitized Solar Cell using a TiO_2/ZnO Eosin Y Electrode" by Kim et al., Solar Energy Materials & Solar Cells 79, pages 495-505 (2003) (hereinafter referred to as "KIM").

Regarding claim 14, KIM teaches a method for manufacturing a nano-particulate electrode for Dye Solar Cells (see generally abstract) including the steps of:

- providing an electrically conductive substrate (see pages 496-497 teaching the use of ITO-coated glass substrate);
- forming a nano-particulate layer on the substrate (see page 497 teaching the formation of a TiO_2 layer on the ITO-coated glass substrate);
- electrolytically treating the nano-particulate layer in an electrolyte (see page 497 teaching the electrodeposition onto the TiO_2 layer a ZnO /Eosin Y layer), wherein

the electrolyte contains ions chemically different to the nano-particulate layer and the electrolytic treatment step comprises transferring the chemically different ions into the surface of the nano-particulate layer (see page 497 teaching the deposition of Zn ions on the TiO₂ layer); and

- applying a dye to the nano-particulate layer (see page 497 also teaching the electrolytic treatment with zinc also including a dye, Eosin Y).

Regarding claim 23, KIM teaches the method for manufacturing a nano-particulate electrode for Dye Solar Cells further comprising the step of the electrolytically treating including at least one step of transferring a predetermined amount of electrical charge between the electrolyte and the nano-particulate layer (see page 503 teaching the deposition occurring for set time periods at a voltage of -1.0 V).

Regarding claim 29, KIM teaches a method for manufacturing a nano-particulate electrode for Dye Solar Cells (see generally abstract) including the steps of:

- providing an electrically conductive substrate (see pages 496-497 teaching the use of ITO-coated glass substrate);
- forming a nano-particulate layer on the substrate (see page 497 teaching the formation of a TiO₂ layer on the ITO-coated glass substrate);
- electrolytically treating the nano-particulate layer in an electrolyte (see page 497 teaching the electrodeposition onto the TiO₂ layer a ZnO/Eosin Y layer), wherein the electrolyte contains ions chemically different to the nano-particulate layer and

the electrolytic treatment step comprises transferring the chemically different ions into the surface of the nano-particulate layer to a depth of approximately 40 Angstroms (see page 497 teaching the deposition of Zn ions on the TiO₂ layer); and

- applying a dye to the nano-particulate layer (see page 497 also teaching the electrolytic treatment with zinc also including a dye, Eosin Y).

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over REGAN as applied to claim 14 above.

Regarding claim 16, REGAN fails to explicitly teach the method further comprising the step of heating following the electrolytic treatment step.

However, REGAN also teaches the use of hot air at 380 °C as a means of drying the electrode after rinsing the electrode after the first electrolytic deposition of the ZnO layer onto the substrate (see "Experimental" section on page 1266).

Moreover, one of ordinary skill in the art would have readily appreciated the benefit of rinsing the electrode after the electrodeposition of the CuSCN onto the ZnO

layer as a means of removing unused electrolyte with a subsequent drying step as employed after the first electrodeposition step.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to further include an additional drying step after the electrolytic treatment of REGAN depositing the CuSCN in order to provide for a heat treatment after the electrolytic treatment as claimed.

5. Claims 17, 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over REGAN or KIM as applied to claim 14 above and further in view of Zangari et al., (U.S. Pub. No. 2002/0145826) (hereinafter referred to as "ZANGARI") with evidence from Sager et al., (U.S. Pat. No. 6,852,920) (hereinafter referred to as "SAGER") and Lopatin et al., (U.S. Pat. No. 6,340,633) (hereinafter referred to as "LOPATIN").

Regarding claims 17, 25 and 26, neither REGAN nor KIM teaches the partial removal of material from the nano-particulate layer to the electrolyte during the electrolytic treatment, the electrolytic treatment including first and second half-cycles wherein the first half-cycle is a deposition step and the second half-cycle is a removal step, and the electrolytic treatment including first and second cycles where the second cycle is larger than the first.

It is noted that the above noted limitations all appear to relate to the use of a pulse-reverse electrodeposition or periodic reverse electrodeposition method. However, ZANGARI teaches the use of various plating waveforms such as a pulse-reverse

electrodeposition method for depositing metal oxides that includes alternating periods of deposition and removal of ions from the substrate (see ¶36). Additionally, ZANGARI teaches that it is known to alter the timing of the waveform pulses (see ¶33). Moreover, as evidenced by SAGER, it is known in the art that one of the benefits of using an electrodeposition method is the ability to alter the properties of the deposited layer by varying the waveform properties (see col. 10 lines 32-64 teaching the benefits of using a pulsed plating electrodeposition technique including control over the crystal sizes, crystallinity and adhesion of the formed nanostructure layers).

Additionally, as evidenced by LOPATIN, the use of an increasing pulse reverse current waveform is also known (see figure 4a).

Consequently, it would have been obvious to one of ordinary skill in the art to alter the times of the deposition and removal steps so as to enable the formation of a layer having the desired properties.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use various waveforms including a reverse pulse waveform having the characteristics as claimed for forming the layer having the desired properties.

6. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over REGAN or KIM as applied to claims 14 and 23, and further in view of Cohen, (U.S. Pat. No. 4,142,947) (hereinafter referred to as "COHEN") and Loch, (U.S. Pat. No. 4,666,567) (hereinafter referred to as "LOCH") with evidence from SAGER.

Regarding claim 24, neither KIM nor REGAN teaches the deposition waveform being a constant current waveform.

However, COHEN teaches the use of a constant current waveform for the deposition of a nonmetal coating (see col. 4 lines 49-52).

Additionally, LOCH teaches the use of an electrodeposition protocol comprising a constant current portion followed by a subsequent constant voltage portion in order to avoid the system reaching too high of a deposition voltage (see figure 1B and discussion at col. 4 lines 60-65 teaching the problem of reaching too high a potential during electroplating operations; see also figure 9 teaching a portion of constant current control followed by a constant voltage control so as to keep the voltage below the burn voltage until the conclusion of the electroplating process).

Furthermore, as evidenced by SAGER, it is known in the art that one of the benefits of using an electrodeposition method is the ability to alter the properties of the deposited layer by varying the waveform properties (see col. 10 lines 32-64 teaching the benefits of using an electrodeposition technique including control over various properties of the deposited layer as well as control over the deposition rate).

Additionally, the use of the plating profile of LOCH providing for the constant current and constant voltage control modes would provide for the plating of the layer at a maximum rate while avoiding the maximum voltage of the system (see col. 10 lines 19-21).

Moreover, one of ordinary skill in the art would have appreciated the importance of optimizing the plating profile for the particular electrolyte system and it would have been within the level of skill of one of ordinary skill in the art to do so.

The simple substitution of one known element for another is likely to be obvious when predictable results are achieved. See *KSR Int'l Co. v. Teleflex Inc.*, 82 USPQ2d 1385, 1395–97 (2007) (see MPEP § 2143, B.).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use a constant current waveform for forming the layer as taught by COHEN followed by a constant voltage mode as taught by LOCH in the electroplating methods of KIM or REGAN in order to provide for the predictable result of having a plating profile as claimed.

Response to Arguments

Applicant's arguments with respect to claims 14, 16-19 and 23-30 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRYAN D. RIPA whose telephone number is 571-270-7875. The examiner can normally be reached on Monday to Friday, 9:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Harry D Wilkins, III/
Primary Examiner, Art Unit 1723

/B. D. R./
Examiner, Art Unit 1723